

the CENR prepared preliminary strategies for establishing scientific approaches and short-term priorities for seven programmatic and three cross-cutting issue areas in which to address the administration's concerns about federal R&D efforts. The programmatic issues include air quality, biodiversity and ecosystems, global change, natural disasters, resource use and management, toxic substances and hazardous and solid waste, and water resources, coastal, and marine environmental research. The three cross-cutting issues are risk assessment, social and economic sciences, and technology and engineering.

The areas outlined in the preliminary strategic plans will provide the structure for addressing key weaknesses in federal R&D that have been raised in a number of reports over the last two years, including program integration, interagency cooperation, links to the policy formulation process, partnerships with industry and academia, research approaches that address long-term scientific issues as well as short-term management and regulatory requirements, need for expanded federal efforts in the biological and social sciences, and human resource development.

Some of the key administration officials who took part in the forum are John Gibbons, assistant to the president for science and technology; Vice President Al Gore; Secretary of Interior Bruce Babbitt; Robert T. Watson, associate director for environment of OSTP; D. James Baker, under secretary for oceans and atmosphere of the Department of Commerce; EPA Administrator Carol Browner; and Kathleen McGinty, director of the White House Office of Environmental Policy. Interagency cooperation, sustainable development, and effective integration of science and policy were major themes throughout the addresses given during the forum.

Browner offered three suggestions to guide the federal research agenda. First, move away from basing regulations on risks to the average person to protecting those populations who are most at risk, including children, minorities, pregnant women, and the elderly. Second, use an ecosystem approach that recognizes the integration of natural resources; for example, air pollution in water that is eventually consumed by animals and humans. Finally, incorporate industrial incentives for preventing pollution and reducing consumption, rather than devoting increasing resources to the development of better waste disposal technologies.

At the forum, strategic plans in each of the 10 areas were reviewed and finalized. These documents will form the rationale for selecting high-priority research areas for

inclusion in budget requests for fiscal year 1996.

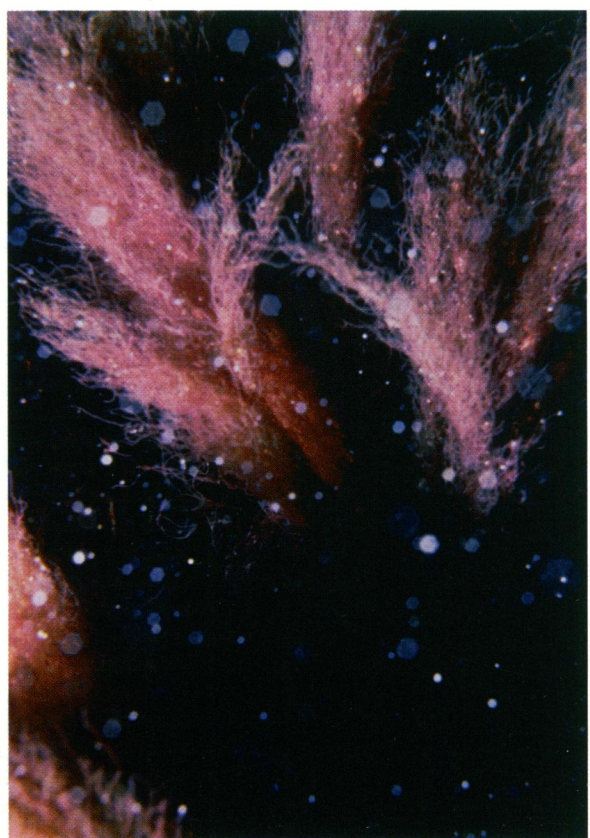
## Underwater Drugstore

Always in search of new disease-fighting substances, scientists are now diving into the ocean for new possibilities. According to scientists, the world's oceans are more genetically diverse than tropical rain forests and may contain creatures that could have pharmaceutical uses. Many of the millions of organisms in the ocean have already been found to produce chemicals that have a variety of uses, such as deterring crop predators and checking growth of weeds. Scientists believe these natural compounds could be used in medicine.

The marine environment is "incredibly diverse biologically and is enormously complex," said William Fenical, director of the Marine Research Division at the Scripps Institution of Oceanography in La Jolla, California. "But I think the ocean is 25 to 50 years behind the study of terrestrial environment. We need to turn to the marine environment for the discovery of new drugs."

A research team in Oregon, headed by marine chemist William H. Gerwick, a professor of pharmacy at Oregon State University, is one of the leaders in the field. Gerwick is supported by the Oregon Sea Grant and is working under a five-year, \$1 million grant from the National Cancer Institute. NCI is funding three discovery teams consisting of university, government, and corporate researchers exploring marine organisms as sources of new anti-cancer agents.

Gerwick's work has shown some success thus far. He discovered and received a preliminary patent for an anti-cancer compound in a tropical alga, *Lyngbya majuscula*, found off the island of Curacao near Venezuela. Studies show that the chemical, curacin A, is lethal to cancer cells in a test tube. According to Gerwick, the compound inhibits cells from dividing due to its extreme toxicity; a concentration of one part per billion is enough to kill a cell. Tests involving administration of curacin A to mice are currently being run by NCI. According to Gerwick, the drug shows some selectivity for colon and breast cancer. "It's a long pathway to becoming a clinically useful drug, but the chemical



**Cure in Curacao?** Curacin A, a substance in algae found off Curacao, may be lethal to cancer cells.

shows all the characteristics of an agent that could go the distance," Gerwick said.

Dale G. Nagle, a doctoral student on Gerwick's team, collected the algae. "You can't really tell from looking at it about what's going on," Nagle said. "This alga is growing like fine little hair out there, and nothing seems to be eating it. That gives a slight hint there's something toxic in there."

Matthew Suffness, program director of NCI's National Cooperative Natural Product Drug Discovery Group in Bethesda, Maryland, said, "The marine natural products area is becoming more and more prominent in science. We're very hopeful that we're going to get quite a number of interesting compounds out of it with potential to be developed into new agents."

Another promising anti-cancer compound that has been discovered is bryostatin 1. This chemical is produced by tiny, spongelike sea creatures called bryozoans, which are usually found in colonies attached to boat bottoms, docks, and seaweed. After preliminary tests in humans, the compound appears to be effective in treating melanoma, lymphomas, leukemias, and ovarian cancers. The chemical is "very mundane-looking and is actually a pest in our harbors," said George R. Petit, director of the Cancer Research Institute at

Dale Nagle



Arizona State University, which discovered the compound.

The promise of these and other possible disease-fighting compounds beneath the ocean's surface emphasizes the importance of protecting biodiversity. Many environmental groups have turned their attention to oceans because human activities are harming the seas. Some of these activities include wetlands destruction, overfishing, discharge of chemical pollutants, and dumping trash into the oceans. Groups such as The Audubon Society's Living Oceans Program aim to reform laws concerning marine and fisheries management for stricter regulations and more protection. One such law, the Magnuson Fisheries Conservation and Management Act, manages living marine resources and is up for reauthorization.

## Persian Gulf Puzzle

In addition to its military outcomes, the 1991 Persian Gulf War gave rise to a public health puzzle that may take years to solve. At the end of a workshop in Bethesda, Maryland, on April 27–29, a blue-ribbon panel convened by the NIH Office of Medical Applications Research concluded that more research is needed to unravel the mystery of what is being called "Gulf War illness."

At the workshop on "The Persian Gulf Experience and Health," a multidisciplinary panel compiled by the National Institutes of Health heard evidence from environmental and occupational health scientists, military physicians, epidemiologists, and a number of Persian Gulf veterans and family members on what Major General Ronald R. Blanck of the Walter Reed Army Medical Center described as a "prolonged, nonresolving illness arising in soldiers either during or after deployment to the Persian Gulf . . . ,

The working case definition includes three major criteria—deployment to the Persian Gulf between 8 August 1990 and 31 July 1991; the onset of a persistent, relapsing, debilitating illness severe enough to reduce or impair ordinary activity for at least six months, and the exclusion of other known clinical conditions that could account for symptoms, which include severe fatigue, respiratory symptoms, unremitting diarrhea, sleep disturbances, irritability, and incapacitating joint and muscle pain.

More than two dozen presenters and an often vocal audience discussed the factors that complicate accurate diagnosis of Persian Gulf veterans' illnesses. First, little baseline health data were collected among troops before deployment, and monitoring of their exposures to environmental toxins

did not begin until months after the fighting. For example, collection of air quality data started months after many of the oil-field fires had been extinguished, and administration of blood tests to determine types of exposures the soldiers received was erratic at best.

Second, no well-designed epidemiologic studies have been done to link Gulf War exposures with the reported illnesses. The different military branches, the Veterans Administration facilities, and civilian physicians have followed different protocols in evaluating undiagnosed Gulf War illness.

Third, no single or multiple etiology or biological explanation for the reported symptoms has been identified from the data available, although the panel emphasized that many veterans are in fact becoming sick and that the environment of the Gulf War contained many potential causes for these illnesses.

Over 700,000 troops, mostly from the United States, fought on dry terrain in Kuwait and Iraq, where powdery sand, often permeated with pesticides, was constantly being blown and stirred by heavy equipment. The attitude of local oil and chemical industries toward the environment is casual; the Persian Gulf is one of earth's most polluted bodies of water.

In late February 1991, retreating Iraqi forces detonated oil wells, and dense smoke covered much of the area. Crude oil poured from broken pipes, and, with water scarce, troops routinely went two weeks or longer between showers or fresh clothing. To quell the dust, the Army poured thousands of gallons of oil around living quarters, working areas, and even hospitals. When the desert nights turned cold, troops warmed confined spaces by burning diesel oil in commercial heaters designed for kerosene, probably resulting in elevated concentrations of sulfur dioxide, nitrous dioxide, nitric acid, sulfuric acid, ammonium sulfate, carbon monoxide, lead, and respirable particulates.

Investigators also attribute the illnesses to factors ranging from depleted uranium used in tank armor and armor-piercing weapons to the chemical and biological weapons Saddam Hussein boasted about. Botulinus and anthrax vaccinations given to troops on a sometimes accelerated schedule are also suspect, as well as pyridostigmine, a prophylactic drug taken by some troops to block anticipated neurotoxic agents. Some believe American personnel may have been vulnerable to unusual forms of infections endemic in Southwest Asia that are unfamiliar to American clinicians.

The Walter Reed Army Hospital reported 7 of 10 patients with Persian Gulf illness had an unusual, intestinal form of infection

by *Leishmania tropica*, a parasite that usually infects the skin. Alan J. Magill, a physician at Walter Reed, hypothesized that leishmaniasis was spread by the ubiquitous sand flies, and may cause a spectrum of illnesses, including a chronic form caused by reactivation long after exposure. "It is unlikely that our group has diagnosed all or even the majority of potential infections," he said.

Still other researchers are pointing to factors such as fear of chemical, biological, and nuclear weapons as a possible explanation for the illnesses. The panel concluded that Gulf War troops experienced "unprecedented stress" due to anxiety about possible chemical and biological warfare intensified by false alarms from oversensitive detection devices. Although the typical symptoms of post-traumatic stress disorder were not evident, a higher percentage of soldiers in the National Guard and reserves appeared to have acute anxiety expressed as physical symptoms.

The workshop panel urged the Department of Defense to consult outside experts in developing plans to measure environmental health factors in future military actions.

As of February 1994, approximately 16,000 veterans had been enrolled in a Persian Gulf Registry for war-related health problems established by Congress at the Centers for Disease Control. In May, the Pentagon announced that it will begin administering standardized tests on hundreds of veterans to determine if there is a single cause for the reported illnesses. Stephen Joseph, assistant secretary of defense for health affairs announced May 12 that the purpose of the study is to move "as quickly and as intensively as we can to provide a diagnostic explanation, veteran by veteran, for the symptoms they're describing."

## Dangerous Dyes

Frequent contact with chemicals in various cosmetics and hair dyes may cause serious health problems, according to recent studies. Researchers have found that female cosmetologists who regularly use chemicals while pregnant nearly double their risk of miscarriage. Other studies have also linked the regular use of hair dye with increased risks of cancer.

A survey of 8356 licensed female cosmetologists ages 22–36 was conducted in North Carolina between 1983 and 1988. The main analysis was restricted to 96 cosmetologists who had a spontaneous abortion and 547 cosmetologists who had a single live birth, all of whom worked full-time in cosmetology or in other jobs during the first trimester of pregnancy. The results revealed associations between miscarriages and the number of hours worked per day in cosmetology, the number of